

Mark Scheme (Results)

Summer 2013

GCSE Mathematics Linked Pair Pilot
Methods in Mathematics (2MM01)
Higher (Calculator) Paper 2H

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NOTES ON MARKING PRINCIPLES

- 1 All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- 2 Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- 3 All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- 4 Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- 5 Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- 6 Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:
 - i) *ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear*
Comprehension and meaning is clear by using correct notation and labeling conventions.
 - ii) *select and use a form and style of writing appropriate to purpose and to complex subject matter*
Reasoning, explanation or argument is correct and appropriately structured to convey mathematical reasoning.
 - iii) *organise information clearly and coherently, using specialist vocabulary when appropriate.*
The mathematical methods and processes used are coherently and clearly organised and the appropriate mathematical vocabulary used.

7 With working

If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks. Send the response to review, and discuss each of these situations with your Team Leader.

If there is no answer on the answer line then check the working for an obvious answer.

Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks. Discuss each of these situations with your Team Leader.

If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

8 Follow through marks

Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

9 Ignoring subsequent work

It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: e.g. incorrect canceling of a fraction that would otherwise be correct

It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect e.g. algebra.

Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

10 Probability

Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

11 Linear equations

Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

12 Parts of questions

Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another.

13 Range of answers

Unless otherwise stated, when an answer is given as a range (e.g 3.5 – 4.2) then this is inclusive of the end points (e.g 3.5, 4.2) and includes all numbers within the range (e.g 4, 4.1)

Guidance on the use of codes within this mark scheme

M1 – method mark
A1 – accuracy mark
B1 – Working mark
C1 – communication mark
QWC – quality of written communication
oe – or equivalent
cao – correct answer only
ft – follow through
sc – special case
dep – dependent (on a previous mark or conclusion)
indep – independent
isw – ignore subsequent working

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
1			62	3	M1 for correct area of one face eg 5×3 or 5×2 or 2×3 M1 for correct method to find the sum of the correct areas of at least 5 faces A1 cao NB: Any attempt to find volume gets no marks
2			17.40	2	M1 for $11.60 \div 8 (= 1.45) \times 12$ oe A1 for 17.40 (accept 17.4)
3	(a)		7.5	2	M1 for $5 + 5 \div 2$ or 5×1.5 oe A1 for 7.5 oe
	(b)		280	3	M1 for $\frac{1}{8} \times 320$ oe (= 40) M1 for $320 - '40'$ A1 cao OR M1 for $1 - \frac{1}{8}$ or $\frac{7}{8}$ oe M1 for $320 \div 8 \times 7$ oe A1 cao

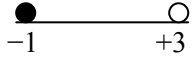
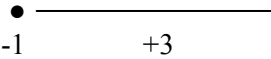

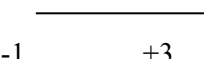

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
4	(a)		7 : 3	2	M1 for 14 : 6 oe A1 for 7 : 3 [SC: B1 for 3 : 7 if M0 scored]
	(b)		2	3	M1 for $(20 - 5) \div (4 + 1)$ (= 3) M1(dep) for $4 \times "3"$ A1 cao
*5		<p>Angle $BAC = 76$ Angle BAP $= 180 - 90 - 54$ $= 36$ $x = 76 - 36$</p> <p>OR</p> <p>Angle $QCD = 54$ Angle ACP $= 180 - 76 - 54$ $= 50$ $x = 180 - 90 - 50$</p>	40°	4	<p>B1 for angle $BAC = 76$ (could be just on the diagram) M1 for $76 - "(180 - 90 - 54)"$ A1 for $x = 40^\circ$ (explicitly stated) C1 for 'the sum of the <u>angles</u> of a <u>triangle</u> is <u>180</u>' and 'alternate angles on parallel lines are equal'</p> <p>OR</p> <p>B1 for angle $QCD = 54$ (could be just on the diagram) M1 for $180 - 90 - "(180 - 76 - 54)"$ A1 for $x = 40^\circ$ (explicitly stated) C1 for '<u>corresponding angles</u> on parallel lines are equal' and 'sum of the <u>angles</u> on a <u>straight line</u> is <u>180</u>' and 'the sum of the <u>angles</u> of a <u>triangle</u> is <u>180</u>'</p> <p>OR '<u>corresponding angles</u> on parallel lines are equal' and '<u>exterior angle</u> of a triangle is equal to the sum of the two <u>interior opposite</u> angles'</p>

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
*5 (con)					OR M1 for angle QCB = $180 - 54 (=126)$ M1 for $180 - 90 - "126 - 76"$ A1 for $x = 40^\circ$ (explicitly stated) C1 for sum of ' <u>allied angle = 180</u> ' and 'the sum of the <u>angles</u> of a <u>triangle</u> is <u>180</u> '

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
6	(a)		$x > -3$	1	
	(b)			2	<p>M1 for:</p>  <p>Accept this line drawn with any length</p> <p>OR</p>  <p>Accept this line drawn with any length</p> <p>OR</p>  <p>Accept this line drawn with any circles</p> <p>OR</p>  <p>A1 for a fully correct diagram</p>
	(c)	$2p > 11 - 3$ $2p > 8$	$p > 4$	2	<p>M1 for a clear intention to subtract 3 from both sides (in an inequality) or to divide all terms by 2 (in an inequality)</p> <p>A1 for $p > 4$</p> <p>[SC: B1 for $p = 4$ if M0 scored]</p>

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
7	(a)		Proof	2	M1 for $x + x + 3 + x + x + 3$ A1 for explicitly stating $D = 4x + 6$
	(b)		$x = \frac{D-6}{4}$	2	M1 for $4x = D - 6$ (a clear intention to subtract 6 from both sides) or for $\frac{D}{4} = \frac{4x}{4} + \frac{6}{4}$ (a clear intention to divide all terms by 4) A1 for $x = \frac{D-6}{4}$ oe [SC: B1 for $x = D - 6 \div 4$ if M0 scored]
8	(a)		23	2	M1 for $3 \times 5 - 2 \times -4$ oe A1 cao
	(b)		-8	1	B1 cao
	(c)		176.4	2	M1 for squaring the 6 first then multiplying by $\frac{1}{2} \times 9.8$ oe A1 cao

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
9	(a)		$x > 12$	1	B1 for $x > 12$ or $12 < x$
	(b)		$y \leq 20$	1	B1 for $y \leq 20$ or $20 \geq y$
10	(a)	$\pi \times 6^2 \times 8$	905	2	M1 for $\pi \times 6^2 \times 8$ A1 for an answer in the range 904 to 905.2
	(b)	$2 \times \pi \times 6 \times 8$	302 cm ²	4	M1 for $2 \times \pi \times 6$ oe M1 for " $2 \times \pi \times 6$ " $\times 8$ A1 for an answer in the range 301 to 302 B1 (indep) for cm ²

Paper: 5MM2H_01

Question	Working	Answer	Mark	Notes
11		60	4	M1 for $8^2 + \text{base}^2 = 17^2$ oe or $17^2 - 8^2$ oe M1 for $\sqrt{(17^2 - 8^2)}$ oe M1 (indep) for their $\text{base} \times 8 \div 2$ oe A1 cao OR M1 for $\cos "x" = 8/17$ M1 for $\text{inv cos } 8/17$ (=61.9...) M1 for $\frac{1}{2} \times 8 \times 17 \times \sin '61.9...'$ A1 cao
12		380	3	M1 for $1 - 0.15$ (= 0.85) or $100 - 15$ (= 85) M1 for $323 \div 0.85$ oe or $323 \div 85 \times 100$ oe A1 cao [SC: B2 for $280.8 - 281$ if M0 scored]
13	$(\pi \times 10) \div 4 = 7.854$ $7.854 + 5 + 5$	17.85	3	M1 for $\pi \times 10$ (= 31.4) M1(dep) for " $\pi \times 10$ " $\div 4$ oe (= 7.854) A1 for an answer in the range 17.85 to 17.86 [SC: B1 for 13.9 ... if M0 scored]

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
14	(a)	$1 - 0.45^2 = 1 - 0.2025$ $= 0.7975$ $\sqrt{0.7975}$	0.893	2	B2 for 0.893(028555....) [B1 for 0.9 or 0.89 or 0.7975 seen]
	(b)		1.5	1	B1 for 1.5 oe
15		$\tan x = 14 \div 7.5$ $= 1.86666\dots$ $\tan^{-1} 1.8666\dots$	62	3	M1 for $\tan x = 14 \div 7.5 (= 1.86666\dots)$ M1 for $\tan^{-1} (14 \div 7.5)$ A1 for answer in the range 61.7 to 62

Paper: 5MM2H_01

Question		Working	Answer	Mark	Notes
16	(a)		-2 -1 0 1 2 3 10 3 0 1 6 15	2	B2 for a fully correct table (B1 for 2 correct y -values)
	(b)		Quadratic graph (overlay)	2	M1 ft for plotting at least 5 of their points correctly A1 for the correct graph
	(c)	Line $y = 3$ drawn OR $(2x - 3)(x + 1) = 0$	$x = -1$ and 1.5	2	M1 for drawing of $y = 3$ or indication of points on "graph" at $y = 3$ A1 for $x = -1$ and 1.5 or ft the readings from their graph at $y = 3$ OR M1 for $(2x - 3)(x + 1) (= 0)$ A1 for $x = -1$ and 1.5 OR M1 for correct substitution into the quadratic formula A1 for $x = -1$ and 1.5

Paper: 5MM2H_01

Question	Working	Answer	Mark	Notes
17	$9x + 6y = 27$ $\underline{4x - 6y = 38}$ $13x = 65, x = 5$ $15 + 2y = 9, y = -3$ <p>OR</p> $6x + 4y = 18$ $\underline{6x - 9y = 57}$ $13y = -39, y = -3$ $3x - 6 = 9, x = 5$	$x = 5, y = -3$	4	<p>M1 for full method to eliminate x or y, allow one arithmetic error</p> <p>A1 for either $x = 5$ or $y = -3$</p> <p>M1 (dep) for substitution of one variable into one of the equations, or by appropriate method after starting again</p> <p>A1 cao for $x = 5$ and $y = -3$</p> <p>OR</p> <p>M1 for full method to make x or y the subject in one of the equations</p> <p>A1 for a correct rearrangement</p> <p>M1 (dep) for substitution of this variable into the other equation</p> <p>A1 cao for $x = 5$ and $y = -3$</p>
18	$T = kd$ $27 = 6k, k = 4.5$ $d = 11.25 \div 4.5$ <p>OR</p> $11.25 \div 27 = 0.4166\dots$ $0.4166\dots \times 6$	2.5	3	<p>M1 $T = kd$</p> <p>M1 for correct method to find k eg $27 = 6k$</p> <p>A1 cao</p> <p>OR</p> <p>M1 for $27 \div 6$ oe (= 4.5) or $11.25 \div 27$ oe (= 0.4166...)</p> <p>M1 for a complete correct method</p> <p>A1 cao</p>

Paper: 5MM2H_01					
Question	Working	Answer	Mark	Notes	
19	(a)	$10\,000 \times 1.035^2$	10 712.25	3	M2 for $10\,000 \times 1.035^2$ [M1 for $10\,000 \times 0.035 (= 350)$ or $10\,000 \times 1.035 (= 10350)$ A1 cao
	(b)		$V = 10\,000 \times 1.035^n$	2	B2 for $V = 10\,000 \times 1.035^n$ [B1 for $10\,000 \times 1.035^n$ or $V = 10\,000 \times 1.035$]
	(c)	$10\,000 \times 1.035 \times 1.035$ $\times 1.035 \times 1.035 \dots\dots$ OR $1.035 = \sqrt[n]{1.5}$	12	2	M1 for $10\,000 \times 1.035^n$ where $n \geq 3$ A1 cao OR M1 for $1.035 = \sqrt[n]{1.5}$ A1 cao
*20		$x = 0.0151515\dots$ $1000x = 15.151515\dots$ $10x = 0.151515\dots$ $990x = 15$ $x = \frac{15}{990} = \frac{1}{66}$ OR $100x = 1.51515\dots$ $x = 0.01515\dots 99x = 1.5$ $x = \frac{1.5}{99}$ $= \frac{15}{990} = \frac{1}{66}$	Proof	3	M1 for $(x =) 0.0151515(\dots)$ or $1000x = 15.151515(\dots)$ or $100x = 1.51515(\dots)$ or $10x = 0.151515(\dots)$ M1 for two recurring decimals the difference of which is a rational number C1 (dep on M2 scored) for completing the proof by subtracting and cancelling to give a correct fraction

Paper: 5MM2H_01				
Question	Working	Answer	Mark	Notes
21	$\sqrt{100}:\sqrt{16} = 10:4$ $= 5:2$ (or sf = 2.5) 1.2×2.5^3	18.75	4	M1 for a correct method to find a linear scale factor M1(dep) for a correct method to find the volume s.f. from their linear s.f. M1(dep) for $1.2 \times '2.5'^3$ oe A1 for 18.75
22	(a) $m = \frac{-4}{2} = -2$ $c = 4$ (b)(i) Gradient = -2 $2 = -2 \times -1 + c, c = 0$ (ii) Gradient = 0.5 $2 = 0.5 \times -1 + c,$ $c = 2.5$	$y = -2x + 4$ $y = -2x$ $y = 0.5x + 2.5$	3 4	M1 for a correct method to find the gradient M1 for $c = 4$ or $m = -2$ A1 for $y = -2x + 4$ oe M1ft for showing (or stating) that the gradient is -2 A1ft for $y = -2x$ oe M1ft for showing (or stating) that the gradient is 0.5 A1 for $y = 0.5x + 2.5$ oe
*23	$(2n + 1)(2m + 1)$ $= 4nm + 2n + 2m + 1$ $= 2(2nm + n + m) + 1$	Proof	3	M1 for $2n + 1$ oe used to describe an odd number A1 for product = $4nm + 2n + 2m + 1$ where n is not the same as m C1 (dep on M1) for stating that $2 \times '(2nm + n + m)'$ is even since it is a multiple of 2 so adding 1 gives an odd number

Paper: 5MM2H_01				
Question	Working	Answer	Mark	Notes
24	$\frac{1}{2} \times AC \times BC \sin 100 = 25$ $AC \text{ (or } BC) = \frac{\sqrt{25 \times 2}}{\sin 100}$ $= 7.125\dots$ $AB^2 = 7.125^2 + 7.125^2$ $- 2 \times 7.125^2 \times \cos 100$ $= 101.53 - 101.53$ $\times \cos 100$ $= 119.16\dots$ OR $\cos 40 = \frac{1}{2} AB / 7.13$ $AB = 2 \times 7.13 \cos 40^\circ$ OR $\frac{1}{2} AB \quad h = 25,$ $h = 50 / AB$ $\tan 40 = h \div \frac{1}{2} AB$ $= 2h \div AB$ $= 100 / AB^2$ $AB = \sqrt{100 \div \tan 40}$ $= 10.916\dots$ $AC = 10.916 \div 2 \cos 40$	$AC = 7.13 \text{ cm,}$ $BC = 7.13 \text{ cm,}$ $AB = 10.9 \text{ cm}$	6	Find AC or BC : M1 for a correct statement to find AC or BC using 25 and 40° (or 100°) M1 for a complete correct method to find AC or BC A1 for AC or BC in the range 7.12 – 7.13 Then find AB : M1 (dep on M2) for a correct statement to find AB using the sine rule or the cosine rule or $\frac{1}{2} AB$ using ‘7.125’ and 40° M1 for a complete correct method to find AB or $\frac{1}{2} AB$ A1 for AB in the range 10.9 – 10.95

Modifications to the mark scheme for Modified Large Print (MLP) papers.

Only mark scheme amendments are shown where the enlargement or modification of the paper requires a change in the mark scheme.

The following tolerances should be accepted on marking MLP papers, unless otherwise stated below:

Angles: $\pm 5^\circ$

Measurements of length: ± 5 mm

PAPER: 5MM2H_01		
Question	Modification	Notes
Q1	Model and diagram are provided.	Standard mark scheme.
Q6	2 cm gap between numbers. Small vertical lines have been extended above the number line.	Standard mark scheme.

PAPER: 5MM2H_01

Question	Modification	Notes
Q7	MLP: x changed to y	M1 for $y + y + 3 + y + y + 3$ A1 for explicitly stating $D = 4y + 6$
		M1 for $4y = D - 6$ (a clear intention to subtract 6 from both sides) or for $\frac{D}{4} = \frac{4y}{4} + \frac{6}{4}$ (a clear intention to divide all terms by 4) A1 for $y = \frac{D-6}{4}$ oe [SC: B1 for $y = D - 6 \div 4$ if M0 scored]
Q10	Model and diagram are provided.	Standard mark scheme.
Q16	x axis 1.5 cm for 0.5, y axis 1.5cm for 1	Standard mark scheme.
Q21	2 models as well as a diagram are provided.	Standard mark scheme.
Q22	2 cm grid.	Standard mark scheme.

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